P1.12 THE IDAHO ENVIRONMENTAL MONITORING PROGRAM

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1. INTRODUCTION

In the late 1940's, the predecessor to the U. S. Department of Energy (DOE) selected an isolated U. S. Navy weapons test range in the Upper Snake River Plain of Idaho as the site for a nuclear research facility. The mission of the National Reactor Testing Station (NRTS) was to develop peaceful applications of nuclear energy. On December 20, 1951, the world's first nuclear power plant, Experimental Breeder Reactor I (EBR-I), became fully operational at the NRTS. This facility earned its place in scientific history as the first reactor to generate useable electricity from atomic power. Over the years, more than fifty nuclear reactors were constructed and used at this site which is now known as the Idaho National Engineering and Environmental Laboratory (INEEL).

The predecessor to NOAA's Air Resources Laboratory Field Research Division (ARLFRD) was created in 1949 to support the NRTS by developing a basic understanding of the meteorology and climatology in this complex terrain setting. The primary focus was placed on protecting the health and safety of workers and nearby residents through the use of meteorological measurements and the development of transport and dispersion models. For example, one of the first studies examined how local meteorology affected iodine deposition and subsequent uptake into the food chain. To that end, a small network of monitoring stations was deployed to acquire meteorological data for the Upper Snake River Plain. Over the years, additional stations were added to this mesonet to enhance understanding of various meteorological regimes.

Achievements in nuclear technology, however, had a price. Operations at the INEEL had left behind environmental contamination. However, the DOE, State of Idaho, and various organizations have undertaken extraordinary efforts in the cleanup and reclamation of the INEEL.

Historically the public has had little access to the various operations conducted at the INEEL. Real-time access to such measurements has been primarily reserved for routine operations and emergency response needs. However, it has been recognized that scientific information collected for INEEL operations could be of great value to educational programs and the general public. In addition, the availability of such information has forged a better relationship between the public and the INEEL.

As a result, the Idaho Environmental Monitoring Program (IEMP) was created in 1997 as an outreach effort to the communities surrounding the INEEL. The State of Idaho INEEL Oversight Program, ARLFRD, DOE, and the Shoshone-Bannock Tribes jointly support the IEMP. Four weather stations were constructed at publicly accessible locations in southeastern Idaho.

2. STATION DESCRIPTION

These stations are located in Idaho Falls on the Snake River Greenbelt south of the John's Hole Bridge; in Fort Hall off Interstate-15 by exit 80 in the museum parking lot; at the Big Lost River Rest Area on U. S. Highway 20/26 between Arco and Idaho Falls; and northeast of the INEEL in Terreton across from the West Jefferson County Fairgrounds (Fig. 1).

Each station is comprised of a 15-m open-lattice aluminum tower and a kiosk that contains real-time meteorological displays and posters (Fig. 2).

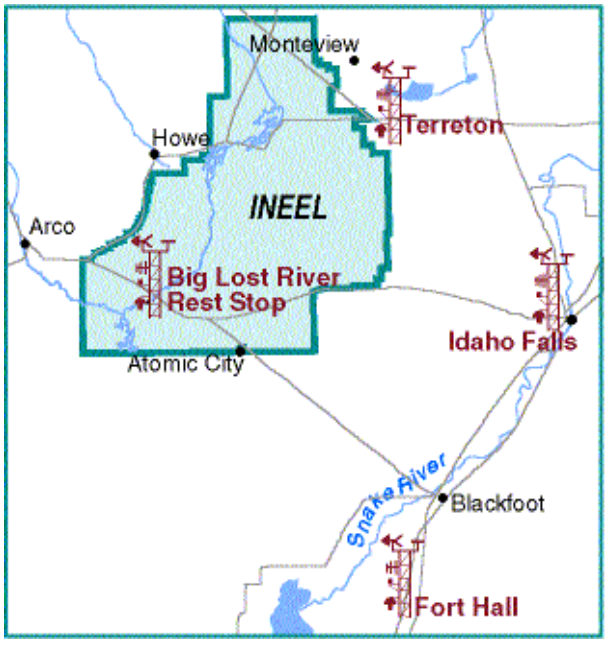

Fig. 1. Map depicting the four IEMP stations.

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Fig. 2. Picture of Idaho Falls IEMP station.

Various meteorological and environmental sensors are mounted on each tower. A cup anemometer and vane are mounted at the top of the tower to measure wind speed and direction, respectively. Ambient air temperature is measured with a thermistor that is placed inside fan-aspirated radiation shields. These shields are necessary to minimize the effects of solar heating. Temperature is measured at 2 and 15 m. The difference in temperature at these two levels provides useful information on determining the stability of the atmosphere. A humidity probe placed inside the 2-m radiation shield next to the thermistor acquires data on atmospheric moisture. A pyranometer is used to measure the incoming solar radiation. Precipitation is measured with a standard 8-inch tipping bucket rain gauge. Heaters placed inside the gauge are used in the winter to melt snow. A aneroid transducer placed at the base of the tower is used to measure barometric pressure.

An air sampler that operates continuously collects particulate matter (PM). Once a week, a filter that is used to collect and retain PM is removed from the sampler and exchanged with a new filter. The used filter is sent to a laboratory where it is analyzed for the gross or total amount of radioactive PM that is acquired by the air sampler. A second auxiliary high-volume air sampler is located at each monitoring site. The high volume air sampler can be activated remotely in the unlikely event that an accidental release occurs at an INEEL facility. Unlike the primary air sampler, this instrument has the ability to detect low-level radioactivity in a short period of time by drawing in large quantities of air at a high inflow rate. These samplers are used to evaluate the air quality from natural (background) sources and any man-made sources.

Gamma radiation is measured using a pressurized ionization chamber (PIC). The PIC is capable of measuring background levels of radiation in the environment as well as additional contributions from man-made activities. The units for the measurement of gamma radiation are micro-Roentgens per hour or the number of ionizations that occur during one hour.

A data logger located at the tower base acquires data from all of these instruments. These data are transmitted through a radio telemetry link to the ARLFRD office every 5 min. Various quality control algorithms are employed on these data to ensure sensor reliability. After these data are screened, they are permanently archived. These data are then available for redistribution and analysis.

The public can view real-time data from these instruments in the open-air kiosks that are located at each station. A summary of the measured variables is listed in Table 1. The wind chill is derived from empirical equations (Blackadar 1984) from the 15-m wind speed and air temperature. The dew point temperature is calculated using the relative humidity, air temperature and barometric pressure (List 1951; Buck 1981). The minimum and maximum temperatures are values since midnight local time. Gamma radiation readings typically range about 11 to 14 μ-Roentgens per hour. This range is indicative of normal background radiation.

Table 1. Real-time display values from IEMP kiosks.

Parameter	*Units*
Wind Direction (15-m)	degrees
Wind Speed (15-m)	miles / hr
Wind Gust (15-m)	miles / hr
Air Temperature (15-m)	°F
Air Temperature (2-m)	°F
Wind Chill	°F
Relative Humidity	%
Dew Point	°F
Solar Radiation	W / m^2
Barometric Pressure	inches Hg
Maximum Temperature	°F
Minimum Temperature	°F
Background Gamma Radiation	μ-Roentgens / hr

Informational displays in the kiosks explain the function of the various instruments and highlight specific topics about a particular measurement that is made at each station. In addition, weekly and monthly climatologies are also posted. The roles of the participating agencies that monitor the environment on and around the INEEL are also explained. The data and information at these stations make environmental science more relevant to the viewer.

Future updates and refinements to the kiosks will include audio speakers to transmit NOAA weather radio broadcasts and a touch-screen display that will provide

interactive programs designed as educational tools on environmental monitoring.

3. INTERNET WEB SITE

About a year after the initial construction of the four IEMP stations, data was made available in near real-time via the Internet at http://oversite.inel.gov. This web site allows access to real-time weather information to students, teachers, and the general public. The user can access the latest 5-min values of the parameters listed in Table 1 from any of the four IEMP stations.

Descriptions of each sensor and its function can be found in the web site. Links are also included for the city of Idaho Falls and Blackfoot Chamber of Commerce, local television stations, regional National Weather Service (NWS) offices, the Idaho State Bureau of Disaster Services, and other popular weather web sites posted by organizations such as The Weather Channel, AccuWeather, and Intellicast. An e-mail address to the webmaster is also available for comments and suggestions for improving the IEMP web page.

The highest access of the web site occurs during the weekdays when people are commuting to and from work. In addition, use of the web site increases during episodes of severe weather conditions. For southeastern Idaho, this usually means extreme cold, snowstorms, and/or high winds.

Future plans include the addition of climatological products for each IEMP station and historical environmental data. The entire database will also be available to any individual wishing to investigate specific historical dates. Interactive programs will be added as educational tools.

4. EDUCATIONAL OUTREACH

Supported by a DOE grant, a workbook on the basic principles of meteorological and environmental monitoring has been developed for distribution to local schools in southeastern Idaho. The in-class reading materials, class activities, and cross-curricular projects will give students the fundamentals to begin exploring the many ways meteorological events influence human life. Hands on experience with instruments, data collection, measurements, and analytical activities will allow students to leap into practical, real-world applications of environmental data.

The workbook contains chapters on each meteorological variable, how it is measured, and what its significance is to our everyday lives. These chapters include detailed discussions on the significance of air temperature, humidity, wind, barometric pressure, cloud types, and radiation. Each chapter includes exercise worksheets and simple experiments. Students are encouraged to visit an IEMP station with their workbooks as part of an organized field trip or on their own time.

In conjunction with the workbook, the INEEL Public Education Program offers a complimentary curriculum entitled *The Rad Experience: A Guide to Understanding Radiation and Radiological Issues*. Compiled by educators participating in the Teaming Teachers with Industry and Teacher Research Associate programs at the INEEL, *The Rad Experience* is a two-week, self-contained unit which encourages students to develop the scientific understanding of radiological concepts that leads to informed opinions concerning environmental issues.

The IEMP has had an impact with students from local school systems. Jake Lambert, a third grade student from Mackay Elementary School, was able to take advantage of the IEMP when he participated in the Region 6 Tech Fair '99 held at Rigby High School in the spring of 1999. Jake compiled weather data from the IEMP web site, organized these data into a spreadsheet program, and illustrated it with computer graphics. He used a digital camera to take pictures of the monitoring stations and incorporated those photos into his presentation. He also corresponded with IEMP scientists via e-mail with thoughtful questions concerning meteorology and environmental monitoring. Jake won First Place in the Tool Software Division at the Tech Fair.

5. CONCLUSION

The Idaho Environmental Monitoring Program is a jointly sponsored venture by the INEEL Oversight Program, NOAA-ARLFRD, DOE, and the Shoshone-Bannock Tribes. As part of an educational outreach effort, the IEMP was created to serve the communities of southeastern Idaho. In its first two years, the IEMP has been successful in bringing meteorological and environmental science to students, teachers, and the general public. More information can be learned on each IEMP partner from the Internet web addresses listed in Table 2. Efforts will continue to refine and improve the kiosk displays, the IEMP web page, and the student workbook.

Table 2. Internet web addresses of the IEMP partners.

NOAA	www.noaa.inel.gov
Oversight	www2.state.id.us/deqinel/main_op.htm
DOE	www.id.doe.gov
Shoshone-Bannock	www.sho-ban.com

6. REFERENCES

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